User Manual

FOR BATTERIES FROM WS TECHNICALS

WS TECHNICALS

WS Technicals A/S
Gjellerupvej 89D
8230 Åbyhøj
Denmark

+45 88 61 83 88
wstech@wstech.dk
wstech.dk

CVR: 37290785

Contents

Preface

Dear customer,

This manual contains relevant information necessary to install, use and maintain batteries from WS Technicals. Read this manual carefully before installing and using the batteries.

1. General Use

1.1 Environmental conditions

Caution!
Our batteries may only be used in conditions specified in this manual. Exposing the battery to conditions beyond the specified boundaries may lead to serious damage to the product and/or the user. Use the battery in a dry, clean, dust free, well-ventilated space. Do not expose the battery to fire or solvents.

When the batteries are placed in an enclosed environment without air circulation, it is advised to provide 2 ventilation holes of 100 mm x 100 mm each, to prevent heat built-up.

Recommended charge temperature range	0°C to +45°C*
Discharging operating temperature range	-10°C to +55°C*
Short term (<1 month) storage temperature range	-10°C to +35°C
Long term (>1 month) storage temperature range	15 ± 5°C (Constant Temperature)
Relative humidity	10-90%

1.2 Operation modes

1.2.1 Discharge

Discharge is when power is being drawn from the battery. The power drawn must never exceed the specified values for your model. Please refer to the specification sheet for your product.

Exceeding specifications for discharging will void all warranties given

1.2.2 Charge

Charge happens when the battery terminals are exposed to a voltage which is higher than the battery's voltage.

The voltage must never exceed the maximum charging voltage found in the specifications for your battery.

Charging must happen like specified in the later chapter "Battery use".

Exceeding specifications for discharging will void all warranties given

1.2.3 Sleep

If the battery does not sense any charge, discharge or active communication, it will sleep, if the BMS incorporates this function. This happens to preserve power and there is a built-in delay before it sleeps. This delay varies with the models.

When in sleep mode, the battery will only consume 1-2% of the current it is consuming when operational, so a battery which has been charged to 40% SoC before storage, will easily be able to maintain a healthy level of SoC during storage.

Recharge the batteries to 40% SoC every 3 months.

1.2.4 Deep discharge

If a lithium battery's voltage drops below a certain value, it will be irreversibly damaged. This state is typically called deep discharge.

To protect the batteries from deep discharge, the battery is monitored by a Battery management system (BMS), which among other features have an under voltage-protection (UV).

The under-voltage protection means that the BMS will monitor the cell voltages and shut off discharge if the voltages drop below the UV threshold for the specific pack.

Please note that the under-voltage protection is not to be viewed as a feature but instead as a safety measure and it is always the user's responsibility to ensure that the voltage never drops below the under-voltage protection threshold.

If the pack is left in the under-voltage state, it will at some point deplete itself to a point where it cannot be recharged again. Such a battery must be discarded.

⚠ **Warning!**
Never store a depleted battery! The battery should be charged to a voltage equivalent of 40% SoC when stored.

- Reaching the under-voltage threshold will void all warranties given.

⚠ **Warning!**
Please note that many chargers will NOT start charging unless they can measure a voltage from the battery, which is not possible if the BMS already has shut off discharging. Therefore, to "wake" the BMS, a charger with a wake-up function is needed. If a BMS has shut down, the wake-up pulse can also be used to power on the BMS again.

Please contact your supplier to learn if your charger supports this.

The wake-up voltage "pulse" should only be applied once (<5 seconds for most chargers employing this function). After this the battery cell voltages should be checked for:

1. Imbalance
- No cell voltages should differ more than 300mV between each other.

2. Low voltage
- No cells voltage should be lower than 2.8V (for Li-NMC), or 2.7V (for LFP – Lithium Iron Phosphate)

If either of these two conditions are not met, the battery should be discarded immediately.

2. Safety guidelines

DO NOT USE THE BATTERY IF IT HAS BEEN DROPPED, EXCESSIVELY HANDLED OR DAMAGED IN ANY WAY!

2.1 General

- Failure to treat the battery as described in this manual, will void all warranties given.
- Always maintain the battery voltage so that the BMS does not enter a protective or erroneous mode.
- Do not serial-connect or parallel-connect the batteries unless told otherwise by WS Technicals or an authorized dealer.
- Do not short-circuit the battery.
- Do not dismantle, repair, modify, crush, puncture, open or shred the battery.
- Do not expose battery to heat or fire. Avoid exposure to direct sunlight.
- Do not remove the battery from its original packaging until required for use.
- Use a battery charger approved by WS Technicals.
- Observe the plus (+) and minus (–) marks on the battery and equipment and ensure correct polarity.
- Do not mix batteries of different manufacture, capacity, size or type within a device.
- Keep the battery clean and dry.
- When storing the battery, it must be recharged to at least a voltage equivalent to 40% SoC every 6 months.
- Retain the original product documentation for future reference.

2.2 Disposal

Dispose of the battery in accordance with all applicable laws and regulations. Batteries may be returned to reseller or WS Technicals at the expense of the user.

2.3 In case you drop the battery

If a battery is dropped, it should not be used. Place it at a location that prevents propagation in case of fire and put it under human surveillance for 30 min. In this time check for signs of internal damage like heat buildup or smoke, before putting the battery aside.

The warranty is void after a battery has been dropped. If the user wishes, the battery can be shipped to WS Technicals for an inspection to verify the functionality of the battery and to reapply the warranty, in case no damage is found inside.

2.4 In case of smoke

⚠ **Warning!**
In case of fire, call your country's fire emergency.

⚠ **Warning!**
In case of a fire, do not inhale the fumes
If the battery starts to give off smoke, disconnect the load or charger and if possible, without touching the battery directly or inhaling the fumes, move the battery outside to a place where a possible fire cannot propagate.

If a battery cannot be moved to another location, a fire blanket, water or other appropriate extinguishing methods can be utilized to prevent the fire from propagating. (Class D fire extinguisher or vermiculite-based).

3. Installation

3.1 General Information

⚠ **Warning!**
Wear protective gear such as gloves and protective glasses while installing batteries.

⚠ **Warning!**
Do not directly touch the battery terminals as these present a hazard in terms of electric shock.

⚠ **Warning!**
Only install the batteries in series if you have a written confirmation from WS Technicals, that this is possible, or if the specifications for your model states that it is.

⚠ **Warning!**
Never install or use a damaged battery.

⚠ **Caution!**
Do not reverse connect the power cables (polarity).

⚠ **Warning!**
Never connect two batteries in parallel if the voltages are not the same. A voltage difference will mean that one battery will charge the other at an extreme current, which can damage the batteries.

When connecting multiple batteries in parallel always use batteries of the same model, age, capacity and with equal pack voltages (+/- 0.2V).

3.2 Unpacking

Check the battery for damage after unpacking. If the battery is damaged, please contact WS Technicals or your reseller. Do not install or use the battery if it is damaged!

3.3 Preparing the battery for use

⚠ **Warning!**
Always keep within the limits specified in the datasheet for the battery model you are using.

3.4 Connecting the battery

⚠ **Warning!**
Some applications will draw power even when left unused. It is the user's responsibility to ensure that deep discharge is prevented by disconnecting or switching off the load, when not used.

Make sure all cables are rated for the current that you are going to draw. This is especially important when paralleling the batteries.

Always use a fuse matching the wires and load.

⚠ **Warning!**
Please notice that each battery must be fused individually, when coupling them in parallel.

⚠ **Caution!**
Some applications may subject the battery to high voltage transients. These may damage the BMS and compromise safety.

3.5 Connecting the batteries in parallel

Before connecting the batteries in parallel, it is extremely important that they have the same pack voltage (+/- 0.2V).

When connecting batteries in parallel it is important that there is an equal cable length from each battery to the load. Failure to do this will lead to imbalances between the connected batteries.

3.6 Connecting the batteries in series

⚠ **Warning!**
Never attach loads to the individual batteries in a series configuration. This will create imbalances and could damage the batteries. If two 24V batteries are connected in series to reach 48V, then 48V is the only voltage you can draw.

Only connect the batteries in series if told by WS Technicals or if the specification sheet explicitly states this is possible and only connect as many as the specifications sheet states.

When the batteries are connected in a series configuration, it is important to minimize the cable lengths.

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4. Battery use

4.1 Charging

⚠ Warning!
Always ensure that the charger is compatible with the battery and that all charging happens within the specifications for the battery. When in doubt, ask your reseller or WS Technicals.

⚠ Warning!
Never plug in more chargers to the same phase, than the phase can supply.

The negative (-) on the charger must be connected to negative (-) on the battery. The positive (+) on the charger must be connected to the positive (+) on the battery.

The charger can be connected while the application is connected.

⚠ Caution!
Disconnect the charger from the battery if it is not to be used for a long time.

Connect the charger to the battery as described in “Connecting and using a charger”

4.2 Charging rate

The standard charging rate (also called C-rating) for the batteries is 0.5C. This means that if the capacity is 40Ah, we can charge with 20A and if the capacity is 100Ah, we can charge with 50A.

Some of the batteries support charging at higher C-ratings. Please consult the specifications for your battery, to learn the possible charging rates for your battery.

At higher charging rates, the battery will increase in temperature. This is expected. If the ambient temperature is high, it is possible for the temperature to exceed the operating temperatures for the battery.

If the temperatures exceed the operating temperatures specified in the data sheet, the battery will prevent charging until it has cooled off.

4.3 Charging method

All lithium batteries from WS Technicals needs to be charged with a Constant current/Constant Voltage method.

In the first phase of charging an empty battery, the charger will use a constant current until the desired end voltage is reached, then it switches to a constant voltage charging, until the current that the battery accepts drops below 5% of the nominal capacity in Amperes.

⚠ Warning!
When the tail-current of 5% of the nominal capacity in amperes is reached, the charger must terminate the charging process.

⚠ Warning!
Mini-cycles and high voltage holds must be prevented by not recharging the battery before the voltage has dropped below the equivalent of 80% SoC.

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4.4 Discharging

When discharging it is important that the current does not exceed the specifications for the battery.

⚠ **Warning!**
It is the user's responsibility to monitor the battery to avoid a deep discharge.

⚠ **Warning!**
After discharging, always charge the battery to at least a voltage equivalent to 20% SoC if it is to be used soon or a voltage equivalent to 40% SoC, if it is to be stored for a prolonged time.

5. Inspection, cleaning and maintenance

5.1 General information

⚠ **Warning!**
Never attempt to dismantle the battery. The batteries do not contain serviceable parts.

Disconnect the battery from loads or charger before inspection.

5.2 Inspection

Check the state of charge (SoC) regularly, especially during long-term storage or infrequent use. The battery will consume a small amount of power, even when it is not in use or being stored.

If the run time drops below 80% of the initial run time or the charging time suddenly increases, please consider replacing the unit.

5.3 Cleaning

Never use any liquids, solvents or other abrasives to clean the battery.

If necessary, clean the battery with a soft and dry cloth.

5.4 Monitor performance

A noticeable drop in runtime (below 80% of initial capacity) or longer-than-normal charging times can indicate aging or damage.

Important: Even if external damage is not visible, older batteries may suffer from internal component degradation due to mechanical shocks, temperature fluctuations, or long-term stress.

Recommendation: Replace any battery that shows signs of wear, performance decline, or has been in service for more than its rated life cycle—even if it appears functional externally.

⚠ **Added Attention After 4 Years!**
Batteries that have been in operation for more than four years require heightened scrutiny. Aging lithium cells are more susceptible to internal failure - even in the absence of external damage. It is strongly advised to perform a professional inspection after four years of continuous or semi-regular use. If there is any doubt about the battery's safety or performance, it should be taken out of service.

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6. Storage

The optimal storage temperature for the battery is 15 degrees Celsius.

The guidelines below must be followed when the battery is not in active usage. Failure to do so will void the warranty.

1. The battery should be charged to a voltage equivalent to 40% SoC
2. Kept at 15 degrees Celsius +/- 5 degrees.
3. Every 6 months the battery should be recharged to a voltage equivalent to 40% SoC

7. Disposal

Always discharge the battery and cover the connectors with electrical tape, before disposal.

Always dispose of the battery in accordance with any applicable laws and regulations.

The battery can be returned to WS Technicals at the expense of the user.

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Contact information

In case of doubt, WS Technicals can be reach via phone or email at:

Email: support@wstech.dk

Telephone: +45 88 61 83 88